Special Final Report

January, 1983

Project: SS-294, ARS Grant, Specific Cooperative Agreement No. 58-519B-9-83, USDA National Dairy Forage Laboratory, Madison

Title: Fermentation in Legume and Grass Silages

Performing Organization: Ohio Agricultural Research and Development Center, Wooster, OH

Personnel: H. R. Conrad, W. L. Shockey, B. A. Dehority, R. W. VanKeuren

The fermentation characteristics and feeding value of ammonia-treated corn silage was studied as one of four experiments during the life of this special grant. Chopped whole corn plants were treated with increments of anhydrous ammonia at ensiling and compared to untreated silage. Total anaerobic bacteria were greater in ammonia-treated silage than untreated and the amounts of fermentation acids changed to less propionic and more butyric. This along with the increased pH of silage indicated a different type of fermentation occurred in ammonia-treated silage. An effect was that the patterns of eating were different among silages. Cows fed silages preserved with relatively greater amounts of ammonia ate more at each meal with larger intervals in between. The important discovery in this experiment was that milk production was the same irrespective of the amount of ammonia contained in the total diet but the quality of milk was improved in that milk protein and milk fat yields were greater when maximum ammonia was used to balance the diet for total protein needs. This is the result of preservation of soluble proteins in the original corn plants and the stimulation of maximum rumen function in the dairy cows at peak lactation causing an increased amount of milk protein to be formed. This experiment is particularly valuable to farmers in those areas where milk is sold on a protein basis. It means that they can obtain a higher price for their milk while producing the same amount of milk.

A major aspect of our continuing studies on the fermentation and utilization of legume grass silages is the determination of the silage components that control and limit feed intake in totally fermented diets. Consequently, we study the eating behavior of cows consuming various types of legume grass forages. Thus, in a second experiment the length, size and interval between eating bouts and meal-to-meal were determined for four forages with lactating dairy cows. The forages used were: 1) low dry matter alfalfa silage, 2) high dry matter alfalfa silage, 3) alfalfa hay, and 4) pelleted alfalfa. Meal lengths were found to be greater with alfalfa hay and intervals between meals were found to be greater for alfalfa pellets. Meal lengths were found to be the

best measure available to distinguish between nibbling and meals followed by the interval of length and the meal size. Nibbling meals are important records in evaluating the constraints on the amount of feed since they are more frequent when feed inhibitory metabolites such as ammonia reaches the central nervous system. From the practical management standpoint, when cows fall into a pattern of nibbling after meals, the total amount of time that is available for them to eat during the day is decreased.

A third aspect of our studies concerns summer feeding of forages. We therefore investigated the use of a herbicide, Pronamide, as a means of maintaining a balance in botanical composition between the legumes in the pasture and the grasses in the pasture. Normally in mixed swards in Ohio the grasses will dominate after two to three years of continuous grazing. We found that the dominance of orchardgrass could be controlled by application of Pronamide in the cool months of autumn, particularly in early November. Thus, on the basis of this study, it can be concluded that low levels of Pronamide application were beneficial to maintaining a mixed sward of orchardgrass in medina clover and applying Pronamide for two consecutive years had no added beneficial effect on botanical composition over application for one year. A notable difference in the treated plots observed during both years was a significant decrease in cell wall content as measured by the amount of neutral detergent fiber and consequently more cell soluble material. This resulted in an increase in the digestibility of the total forage and improved its value for milk production in high-producing dairy cows. However, the application of Pronamide resulted in slightly less dry matter being produced during the total season. This was expected in that a major component of dry matter production is orchardgrass. However, this extra dry matter is primarily in the indigestible portion and the net loss of nutrients to the dairy cow is inconsequential. We conclude that Pronamide is effective as a means of maintaining a mixed sward of legume grass pastures for high-producing dairy cows.

Finally, in the last of four experiments to be reported the Ohio Cluster of the National Dairy Forage Lab has been interested in methods of utilization of additional forages in dairy cattle. To do this it is very important that we have means of evaluating the energy content of forages. Therefore, a summative equation was developed for predicting the net energy for lactation fo feeds from known chemical content for ration evaluation programs. Encrusted area from lignification and inhibition of digestion was estimated by computing the relative surface area of lignin and cell walls. Basically the equation was: the net energy in organic matter in cell contents was added to the net energy in cell wall content after multiplying by the co-efficient for reduction of digestibility associated with encrustation. This ratio was determined as the amount of lignin surface area divided by the amount of neutral detergent fiber surface area. Feeds with net energy contents between the values of cottonseed hulls and shelled corn fit the regression line with equal precision and 98%

of the variance was accounted for. The unique value of this equation is that it is useful for estimating all of the feeds produced on the farm, being equally valuable for shell corn and forages. The main objective of the study was to develop a precise equation for predicting energy values of feeds of known chemical content that could be used in computer programs developed for feed evaluation. The program for these formulas is presently being written for use in standard systems of ration evaluation utilized in various parts of the country.

Manuscripts:

1. Heinrichs, A. J. and H. R. Conrad. 1983. Fermentation characteristics and feeding value of ammonia-treated corn silage. Accepted for publication in the Journal of Dairy Science.

2. Heinrichs, A. J. and H. R. Conrad. 1983. Feed intake patterns of lactating dairy cows. Submitted for publication in the Journal of Animal Science.

3. Heinrichs, A. J., H. R. Conrad, R. W. VanKeuren and G. B. Triplett. 1983. Altering the composition of legume-grass pastures with Pronamide. Submitted for publication in the Journal of Agronomy.

4. Conrad, H. R., W. P. Weiss, W. O. Odwongo and W. L. Shockey. 1983. Estimating net energy lactation from components of cell solubles and cell walls. Submitted for publication in the Journal of Dairy Science.

Copies of the original manuscripts have been provided under separate cover.